

ORIGINAL ARTICLES

BLACK WIDOW SPIDER POISONING*

A PRELIMINARY REPORT ON THE BITE OF THE
BLACK WIDOW SPIDER: SO-CALLED HOUR-
GLASS OR SHOE-BUTTON SPIDER
(*LACTRODECTUS MOCTANS*)

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Indio

DISCUSSION by Emil Bogen, M.D., *Olive View Sanatorium, Olive View.*

THE black widow spider has been well known to the people of Southern California for many years, and the consequences of its bite have also been known. It has lately been found throughout the entire United States. The treatment of black widow spider bite is, therefore, of vital interest to physicians everywhere.

Opinions vary as to the deadliness of the bite of the black widow spider, but there are apparently several authentic cases on record of death resulting from its bite.

DESCRIPTION OF THE BLACK WIDOW SPIDER

Because the black widow spider is not well known, it is well to give a brief description of this deadly arachnid. Apparently the female is more deadly than the male, and the one most to be feared. As will be seen by the accompanying photographs,[†] the black spider is a small, coal-black insect, with shiny body, living in dark, preferably damp, places. Its web is without pattern and is very tenacious. The spider is a natural coward and, as a rule, runs when disturbed. The male of the species is grey-colored or brown, and has a faint white marking on his abdomen.

The female varies in size from very small, about the size of a BB shot, to rather large, almost the

size of a dime, across the body. The body is oval and increases in size up to the period of laying her eggs. On the underneath side of her body there is the characteristic marking, or so-called hour-glass. It is the shape of her body which gives her the name "shoe-button spider," and it is the characteristic marking which gives her the name "hour-glass spider"; her cannibalistic instincts give her the name "black widow spider," since she quickly eats her mate following fertilization.

The marking on the female spider is usually red, and stands out in bold contrast to the blackness of her body. The spider's head is small and has two antennae or feelers, which, as will be seen by the accompanying photographic enlargement, are situated on each side of the mouth.[‡] These are brush-like, and below these feelers are two pincers. These pincers are tipped with very hard, keratin-like prongs, which are the fingers or fangs through which she deposits the poison. In the pincers, lying in their substance, along its medial aspect, there is a little tube which apparently conducts the poison from the poison gland, situated at the base of the pincers, down to their tips.

The poison glands are very minute, and consist of a very fine, membrane-like sac which can be extracted with the fangs, as a rule. The amount of toxin or poison contained in each sac varies with the time which has elapsed since she has last struck a victim.

Fortunately for humans, the spiders are not very aggressive, unless they are bothered or their web is agitated. They are usually found around outdoor latrines, dark closets, basements, garages, etc.

The symptoms of spider bite, of course, vary as with other poisonous insects and reptiles: (1) with the individual's susceptibility to the toxin; (2) the site and depth of the bite; (3) the amount of

* See also page 370 for article on this subject.

† Figure 1.—Female spider on web; side view. Figure 2.—Female spider on web seen from below. Note light area on abdomen. This is the characteristic marking, usually red. Figure 3.—Same spider seen from above. Photographs magnified about eight times.

‡ Figure 4.—Enlargement of pincers or fangs together with the "brush-like" antennae or feelers situated on each side of the fangs and mouth. Figure 5.—Photographic enlargement of fangs, magnified about 120 times.

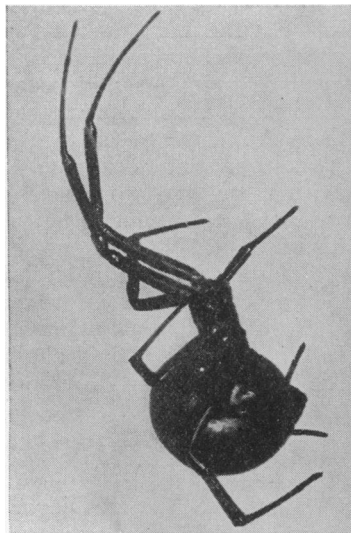


Fig. 1.—Female black widow spider on web—side view.

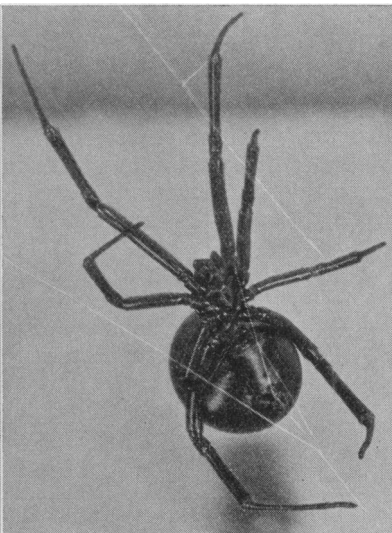


Fig. 2.—Female black widow spider on web, seen from below.



Fig. 3.—Same spider seen from above.



Fig. 4.—Enlargement of pincers or fangs, together with "brush-like" antennae or feelers situated on each side of the fangs and mouth.

toxin injected into the bite; (4) the age and physical condition of the patient.

SYMPTOMS

The symptoms of the spider bite are characterized in practically every instance by the patient's feeling a burning sensation at the instant of the bite. This, however, apparently only lasts a few seconds, and is immediately followed by a feeling of extreme pain across the abdomen, headache, pain and a sense of pressure around the heart, and a sensation of collapse. The pain increases in character and usually quickly spreads, involving all the muscles of the entire body. The patient complains of a headache and the face assumes an anxious look. Beads of cold perspiration usually appear on the face and brow, and the patient is in extreme agony. He also presents symptoms of extreme shock or collapse; cyanosis may also develop. I have seen these symptoms develop within three minutes from the time the patient was bitten. The pain in the abdomen is so severe as to double the patient over, and also so severe as to prevent him from crying out. The rapidity with which these symptoms develop differ greatly from that of other poisonous insects and reptiles. Apparently the poison is a neurotoxin and is conducted by the nerves, since a tourniquet applied to the extremity fails to shut off the flow of the toxin in the body.

REPORT OF CASES

CASE 1.—In 1928, I had my first experience with a black-spider bite. It was the case of a young man about twenty years of age who had been bitten on the index finger while picking tomatoes. He had very severe cramps all over his body, but none of the extreme variety. His pulse was increased, he complained of a sensation of weight around his heart, and had an excruciating headache, but was not nauseated. The treatment consisted of morphin and other sedatives, including 10 cubic centimeters of magnesium sulphate solution intravenously. Because of the excruciating, throbbing type of headache a spinal puncture was

done, and the spinal fluid was found to be under greatly increased pressure. In spite of this treatment the symptoms persisted for about six hours, after which time they gradually subsided, and, aside from being weak, the patient had entirely recovered by the next day. However, it was several days before he was strong enough to go back to work.

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CASE 2.—Not long afterward another patient presented himself for treatment, who had rested his hand on a spider, quickly withdrawing it when he noticed the spider was there. He complained of just a burning sensation all over his body. Examination showed only one break in the skin, which was apparently very superficial. This man quickly recovered without any treatment, and was able to work the next day.

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CASE 3.—A short time later another patient was brought in who had been bitten in his sleep on his left cheek. This patient was extremely ill and, in spite of all known remedies, was apparently doomed to death. As it happened this patient was brought in by the first patient I had, and, since he was not responding to any treatment given, I finally decided to inject the blood of the first patient into this one. I removed 200 cubic centimeters of blood from the arm of the first patient and injected it into the hip of this patient. Within fifteen minutes the symptoms of this patient were rapidly subsiding, and within three hours the patient felt as good as before the bite. Spinal fluid cell count showed 140 cells to the cubic millimeter. The patient's blood pressure was 196/40; temperature was 97.4. Normal blood pressure was 116/70, taken two days later.

COMMENT

In reviewing the literature following this experience, I found that Doctor Bogen of the Los Angeles General Hospital had been using convalescent serum in black-spider bites for some time. Following this experience with the recovery of the patient, convalescent serum or whole blood was used in each instance of spider bite from that time to the present time. However, it is not always convenient to have a donor, and because of the difficulty experienced in keeping the convalescent serum for a long period of time in the heat in this desert locality, there were a few cases where other methods were instituted until a donor could be found. These have included the injection of magnesium sulphate solution intravenously, the injection of calcium chlorid 10 per cent solution



Fig. 5.—Photographic enlargement of fangs magnified about 120 times.

intravenously, morphin, spinal punctures, Mulford's rattlesnake antivenom, and other measures. In all, considerably more than one hundred cases have been seen and treated.

CASE 4.—The most outstanding of all cases which I have had was that of Mr. B. DeC., age 55, a deputy sheriff. The patient was admitted September 30, 1932, at 6:15 p. m., stating he had been bitten on his left arm by a black widow spider about ten minutes before. He was having excruciating cramps throughout his abdomen. He was immediately given one-quarter grain of morphin and one-quarter grain of codein hypodermically. The pain in his abdomen was becoming more severe and at 6:40 he was given morphin, grain one-half. The pain in the abdomen was much more severe, and he began to have a great deal of dyspnea. At the same time he commenced to have a very severe pain in his lower lumbar region. This pain, he stated, "felt as though he were being beaten across the back with a red-hot poker."

At 6:45 the patient began to become cyanosed and stated he had a feeling of suffocation. He was given a few whiffs of chloroform because of the pain, and was also given an ampoule of sodium phenobarbital, for restlessness, together with stimulants. As we only had about 20 cubic centimeters of convalescent serum on hand, he was given that on admission to the hospital. At 7 p. m. he was given another ampoule of sodium phenobarbital, and at 7:10, because of the excruciating headache, a spinal puncture was done. Spinal fluid pressure was greatly increased, and 20 cubic centimeters of clear fluid was removed. The patient began having chills, and was placed in a hot, wet blanket. At 8 p. m. the patient was very restless, moaning and groaning with pain, talking continuously, semi-delirious. His pulse was fairly good quality, and he had acute retention of urine.

Since it was impossible for me to locate a donor for convalescent serum, the sheriff of Riverside County was called and asked to go to Los Angeles County Hospital, where he picked up 200 cubic centimeters of convalescent serum, which was given about 10:30 p. m. All this time the patient was complaining of very severe pain around the hips and back, and he was perspiring and turning continuously. He was also complaining of very severe pain around his heart, and complained of a deep burning through the instep and toes, with slight swelling of both feet. The patient also had a twitching all over his body at times. The blood pressure at this time was 150/80. Following the convalescent serum, the patient had a considerable amount of relief for about six hours, at the end of which time he was complaining of very severe pain across his back, around his heart, and also severe pain of both feet. He was given morphin sulphate and magnesium sulphate; he was also given stimulants. On October 1 at 3:40 a. m., he became very nauseated, vomiting several times. His abdomen became distended and he was given hot compresses to his abdomen. During this time the patient would break out with a very profuse perspiration and become very weak. On October 1 at 7:45 a. m., another 200 cubic centimeters of whole convalescent blood was injected, following which the patient seemed to be improving, although there were times when he would complain very bitterly of headache, tightness around his heart, a cold clammy perspiration, and a feeling of weakness around his heart. The patient continued to have severe abdominal cramps, pain around his heart, pain across his back, with occasional waves of nausea and vomiting for six days. He was extremely weak for one month, being hardly able to stand when allowed out of bed on the fourteenth day. He was unable to return to work for thirty days. The patient was kept in bed for fourteen days, because of the very severe pain he continued to have around his heart. This patient had been examined numerous times previously and had never had any heart symptoms previous to the spider bite. Since his recovery he has had numer-

ous attacks of pain, anginal in character, which might possibly be an aftermath to his spider bite. He was an extremely active and vigorous type of man, being, as he often stated, "as strong as an ox." His usual weight was 227 pounds—at the time of the bite. On October 13, his fourteenth day, his weight was 183 pounds—a loss of forty-four pounds.

COMMENT

The pain and suffering of this patient are indescribable, and it was apparent from the start that the patient was doomed to die unless adequate medication could be given. The amount of convalescent blood and serum necessary to relieve the patient's symptoms indicates he received an overwhelming dose of spider venom.

This patient has been the source of most of my convalescent blood since his recovery. However, I have noticed it takes increasing amounts to give the relief, indicating that the strength of the antivenom manufactured by the body decreases with time.

The sensations of other patients which I have seen vary from very slight prickling to very severe cramps, but the two described above are the most severe reactions I have ever observed.

EXPERIMENTS ON GUINEA-PIGS

In an endeavor to determine whether the spider toxin is as deadly as it is supposed to be, a series of experiments were carried out on guinea-pigs. Pig No. 1 was given the full amount of toxin from both poison sacs of a large black widow spider. This pig very quickly became extremely ill. He became paralyzed in his hind quarters, developed an intense diarrhea, labored respiration, and heart action. He died one hour and fifty-six minutes after the injection. Pig No. 2 was also given the full amount of toxin from another spider. This pig, likewise, became very ill, but did not die.

In the attempt to prove the presence of immune bodies developed in the blood of the pig in which the tolerance of the toxin has been gradually developed, a series of experiments were then conducted.

The contents of the poison sacs of a large black widow spider were dissolved in one cubic centimeter of saline solution. Pig No. 3, on Monday, June 10, 1934, at 2:30 p. m., received .15 cubic centimeter of this fresh spider venom solution injected intraperitoneally. No reaction was noted after ten minutes. Pig No. 4, on Tuesday, June 11, at 4 p. m., received .2 cubic centimeter of fresh spider venom solution injected in the groin. On Wednesday, June 12, Pig No. 3 received .2 cubic centimeter of spider venom solution injected intraperitoneally. Pig No. 4, on the same day, received .25 cubic centimeter of spider venom solution in the groin. On June 13, Pig No. 3 received .3 cubic centimeter, while Pig No. 4 received .45 cubic centimeter. On June 15 they both received one-half the amount of the venom of a spider. On June 17, Pig No. 3 received the venom from one spider, and thirty-two minutes later had a

slight reaction characterized by crying and extreme nervousness, but quickly recovered. On June 18, Pigs No. 3 and 4 received the venom from one and one-half spiders. On June 19, Pig No. 4 was found dead in his cage in the morning.

An autopsy showed the heart to be in systole, the intestines were in marked spasm, and the lungs appeared to be slightly congested. No changes were determinable in the brain. On June 20, Pig No. 3 received the venom of two spiders at 10 a. m. On June 21 the venom of two spiders was again injected. On June 26 the venom of three spiders was injected, and on June 29 the venom of four spiders was injected. On July 1 the contents of the poison sacs of five spiders was injected.

On July 5, Pig No. 5 was given an injection of the venom of a full-grown black widow spider at 10:30 a. m. At 10:45 a. m. slight tremors of the body were noticed, which rapidly increased. The pig became increasingly nervous and irritable, and began crying out as though in extreme agony. At 11:30 the pig was apparently in severe pain and had a partial paralysis of the hind quarters. At 12 noon three cubic centimeters of blood were taken from the heart of Pig No. 3 and injected into the peritoneal cavity of Pig No. 5. There was no decrease in the severity of pain, and at this time the pig was completely paralyzed in his hind quarters and was also crying very piteously. At 12:45 three cubic centimeters of blood was again removed from the heart of Pig No. 3 and injected into the peritoneal cavity of Pig No. 5. At 1:30 p. m. the symptoms appeared markedly less, and it was noticed she could again begin to move her hind quarters. At 2:30 p. m. Pig No. 5 was apparently practically normal, and by 5 p. m. all symptoms had completely subsided and she was eating as well as previously.

IN CONCLUSION

The result of these experiments seem to bear out the theory that an antitoxin or antivenom is developed by the complete recovery from the bite of a black widow spider, and is present in the blood of spider-bite victims or experimental animals; and, if used in time, it is reasonable to suppose will prevent the appearance of the symptoms, or cure, spider-bite poisoning.

In the endeavor to place on the market a black spider antivenom which would be procurable in all parts of the United States, the H. K. Mulford Laboratory has consented to coöperate in an experiment looking toward the development of such an antivenom similar to that already on the market for rattlesnake bite. The experiments are still in the embryonic stage, and it is too early to venture any conclusions as to their practicability.*

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* Acknowledgment is hereby made of the kind coöperation of Miss Carolyn Crockett, technician at Coachella Valley Hospital, in assisting with the experiments; of Dewey Moore of the United States Government Date Gardens for the excellent photographs; and of Ira C. Caswell for furnishing most of the spiders.

DISCUSSION

EMIL BOGEN, M. D. (Olive View Sanatorium, Olive View).—More than six hundred reported cases of black widow spider poisoning, with forty recorded deaths, justify further attention to this condition. The cases presented by Doctor Gray are quite characteristic. The increased spinal fluid pressure is especially noteworthy. In most of the instances reported or observed, however, the symptoms have not arisen immediately, but after a lapse of from five to thirty minutes after the bite, so that in many instances the etiologic relationship is unperceived.

Serum from animals experimentally immunized against the venom of the spider have been used on mice, rats and guinea-pigs, by Hall, Bogen and D'Amour, and on man by D'Amour, with results similar to those reported by Doctor Gray. The experiments should be repeated on a much larger scale, however, and with larger animals, if consistent results are to be obtained and existing sources of error avoided.

Scores of patients have, by this time, been treated with convalescent human blood or serum for spider-bite poisoning, but the exact value of this procedure is not yet certain. The variability in the severity of the symptoms of arachnidism, and the fact that they often begin to subside spontaneously, without treatment, unexpectedly, make it difficult to prove the value of the therapeutic measures taken. The doses used by Doctor Gray are larger than those that have been generally tried, and may be, perhaps, more effective.

Although most physicians who have used convalescent serum observe that the symptoms usually lessen immediately after its use, the fact that institutions using other modern treatments, such as the intravenous injection of 10 per cent solutions of magnesium sulphate, calcium chlorid or calcium gluconate, report scores of cases with no deaths and rapid amelioration of symptoms, seems to make the general use of such serum unnecessary.

EXPERIMENTAL, CLINICAL AND LEGAL ASPECTS OF DRUG ADDICTION*

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THE repeated use of opium, morphin, heroin or dilaudid eventually results in a disease known medically as drug addiction. Morphin is the most active alkaloid found in opium. Heroin and dilaudid are produced synthetically from morphin. Chemically, the three drugs—morphin, heroin, and dilaudid—are phenanthrene derivatives.

It is impossible to read the literature pertaining to the subject of morphin and its derivatives without encountering the terms addiction, habituation, tolerance, abstinence and withdrawal. So many different meanings have been given to these terms by the various investigators that it seems advisable to define them as they are to be used, employing the definition that has been accepted by the foremost workers in the field.

DEFINITIONS

The following definitions have been frequently referred to in the recent literature. (Tatum, Seever and Collins,¹ 1929).

* Read before the Pathology and Bacteriology Section of the California Medical Association at the sixty-fourth annual session, Yosemite National Park, May 13-16, 1935.